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THE ATMOSPHERIC RAILWAY.

Evidence given before a Committee of the House of Commons.

Mr. Barry Gibbons, engineer of the Dublin and Kingstown railway, examined: Trains propelled on the atmospheric principle started and stopped more easily, and with less loss of time, than those with locomotive power. The atmospheric principle on the Dalkey line, compared with the expense of other lines, as to haulage, was much cheaper than the locomotive. The maintenance of way was less favorable in a newly opened line than on an old one. Taking the cost of haulage on the locomotive line of the Dublin and Kingstown, according to the published accounts of the company, the cost of locomotive power on that line was 10 9-10*d.* per train per mile. The maintenance of way was 3 1-10*d.* making a total of 14*d.* The cost of moving power on the atmospheric principle was 7 1-10*d.* and the maintenance of way 1 3-10*d.* Could distinguish the wear and tear of rails on a locomotive line in the space of six weeks. In the estimate of 14*d.* there was an allowance made for wear and tear of rails. In the atmospheric there was no parallel allowance for the pipe. Believed, though there were great curves on the line, that there was no wear and tear of the pipe, and no centrifugal friction. The wear and tear of the pipe would not require an expenditure for fifty years. It became perfectly polished inside, owing to the tallow. In going round sharp curves on a locomotive line, the inside of the rail is worn away by the flange of the wheel. Did not make any allowance in the estimate for wear and tear of rails on an atmospheric line, because it was inappreciable. In the item for haulage, witness debitted wear and tear to the atmospheric railway, which would take place in the stationary engines, and included coals consumed, wear of machinery, and persons employed in the engine house. The cost of coals was 1*l.* 4*s.* 6*d.* per day; wages 12*s.*; wear and tear, oil. etc. 6*s.* If the Dalkey line were longer, the expense would be less. Had laid out an extension of it to Bray, six miles, and an engine would work at both places. There would be more consumption of coal, but at less per train per mile. Paid Messrs. Samuda for the construction of the line, and their estimate was not exceeded by 1*d.* Their promises as to load carried, and velocity attained, had been perfectly accomplished. They entered into a contract to carry trains of 26 tons at 30 miles an hour, and had performed it at double that rate. The Dublin and Kingstown was a very cheap line, and the low fares had in-

creased the passengers enormously. The trains had been increased from time to time, and there had been a corresponding number of passengers. It induced a system of country residence. They estimated that every new house built in the neighborhood of a station was 20*l.* added to the annual receipts. There were four stations on the six miles. The fares were 1*s.*, 8*d.*, and 6*d.*, but there was a reduction to families of 5, 10 and 20 per cent. The average fare was something under 1*d.* The fares on the Dalkey were 2*d.* and 3*d.* They would pay at that. The company received 45*l.* on last Sunday, which would represent 4500 persons. The increase in traffic on the Kingstown railway was not so much to be attributed to reduction of fares as to the frequency of the trains. The coals consumed by the engine on the atmospheric line were 35 cwt. per day, which would keep it working from 8 A. M. to 6 P. M. at intervals. Witness reckoned a daily mileage allowance for wear and tear of piston of 4*d.* per day. One set of piston leathers, costing 16*d.*, worked a fortnight. The rails on the atmospheric line were 52lb. per yard weight. Had examined the pipe, and could find no lateral pressure made by the tube on the piston. The straightforward movement of the piston counteracted the centrifugal force of the curve; but witness did not think that the piston had ever been brought into operation to prevent the carriages going off the line. If it had ever exerted such a force there would have been some indication of it on the pipe. The atmospheric carriages were 15 cwt., or a ton lighter than the locomotive. Witness's estimate for maintenance on the locomotive line was for a double, the estimate for the atmospheric for only a single line. Had made the experiment of stopping the trains almost instantaneously, and had brought up a train to a dead rest, travelling at 40 miles an hour, within 220 yards. There were 7 carriages, and 78 persons in them. The weight of the rails on the Kingstown and those on the Dalkey was precisely the same. The calculation given by witness of 7*d.* for haulage on the atmospheric, was only for one way. If worked backwards and forwards as a locomotive, it would be 14*d.*; but the trains came back by their own gravity, and therefore cost nothing. Were the line on a level, the cost would have to be doubled.

Mr. I. K. Brunel, C. E., examined: Had been consulted on the expediency of working the proposed Croydon and Epsom on the atmospheric system, and had considered its application thereto very fully. Thought that the adoption of the atmospheric plan was well adapted for the working of the proposed line. Taking all things into consideration, the trains could be conveyed in a shorter time by it than by the ordinary locomotive engine, and with greater frequency. Where the trains were not very numerous, could understand that the working expenses would be less by locomotive power than by a fixed engine. In a great number of cases it would be the reverse; the working expenses would be reduced by the atmospheric principle, assuming that a great many trains would run. The prevailing gradients on the Epsom line were 1 in 100, which he thought applicable to a line with a view to economy in working. The diagrams of Mr. Samuda, as to the manner of working the trains might be worked with frequency and safety. There was a point where expensive locomotive power would become more economical than stationary power, if the number of trains were very much reduced. Thought that the atmospheric train could be propelled much faster than is done at present. Had no reason to doubt but that trains might go at a speed of 50 and 60 miles an hour. Had gone at 60 on a locomotive, and thought a train might go easier and at a higher rate by the atmospheric than by the locomotive engine. It had greater speed than the locomotive. It possessed the advantage over the latter of

starting at once into a state of motion from a state of rest. This was a great advantage where there were many stations, as contemplated in the Epsom line. On the Great Western they found that it was six to eight miles from the station before they got into a good maximum rate of running; therefore it was only on a long distance from London to Slough that they did attain their full velocity. With respect to the atmospheric attaining a velocity of 50 miles an hour, it would depend entirely on the power, the size of the pipe, and the degree of vacuum. Did not see any difficulty in their getting it at the end of 2¼ or 3 miles. Had no doubt but that if they chose to put on the power, they might obtain it at 1 mile or 1½. When witness saw the line at Dalkey, it was not laid in a manner which admitted of a very high velocity. Did not think it safe when he made the experiments to go higher than 40 miles. The derangement of the rails, and the difficulty of keeping the railway in perfect order, arose from the weight of the locomotive engines, and the mode of working them on the rails. Witness's object in making the experiments at Dalkey was to satisfy his own mind, with a view to govern him in advising others. The results of these experiments were, that he found they could attain a high velocity on the line in a short time, so as even to attain the rate of 50 miles an hour. Found that the mechanical part of the apparatus and valve was even then in a good working condition, and saw enough to satisfy his mind that it could be rendered still more perfect. Found that a weight was moved at a good velocity of 22 miles an hour—a weight fully as great as that due to the free effect of the vacuum in the piston. Satisfied himself that there was no amount of friction or leakage round the piston, nor other mechanical defects, which would prevent getting the full effect of the vacuum. Was confirmed in the opinion that a mechanical contrivance of that sort could be worked, so as to produce that effect at a less cost than the ordinary mode of applying power by a locomotive. Had in consequence of these experiments advised the promoters of the Croydon and Epsom to adopt the atmospheric. Had no doubt that an atmospheric railway might be made more comfortable to passengers than a locomotive, which was one of the great advantages to be derived from it. Thought that the rails might be kept in much more perfect order than with locomotive carriages; and that carriages might be constructed in a totally different manner from those now in use. The motion would be smooth and noiseless. There was also the absence of coke dust from the chimney. With respect to the experiments of stopping trains, thought that on a railway worked by stationary power, whether atmospheric or other, the power of stopping was greater than it was on a locomotive line. The power to be overcome in stopping a train arose, not from the power of friction, but from the momentum of the train, which, at 40 miles an hour, would be 10 or 15 times as great as the power of traction that could be produced for a distance of 250 yards; and therefore in stopping a train at a short distance of 250 yards, what they had to think of was the momentum of the train. Did not think that the reversing of the engine at all equalled the advantage that might be derived from breaks or slides, such as those Mr. Cubitt spoke of on carriages on the atmospheric line. The reversal of an engine for stopping a train did not produce so much effect as might be supposed. On the Great Western they never reversed; but the break in the tender stopped the train at high velocities. Had calculated the power of the engine at Dalkey. In a commercial point of view, Mr. Samuda's mode of calculating was correct. The power on the atmospheric railway had a facility for adapting itself to the load. That was a great advantage. Where the gradients were steep they could apply more power.

Assuming even that the pipe was not of the same size everywhere, at one small steep part of the line they might work a vacuum up to 18 or 20 inches of mercury, which would not be so economical as working it at 14 or 16 inches. Still, for a short part of the line, they could do so; whereas on the rest of the line they might work at the more economical pressure of 14 to 16 inches of mercury. With respect to the variation of the work, according to the variation in the weight of the train, of course any engine working expansively, and well constructed, would adapt itself to the weight of the train; and the cost of working the engine would be somewhat proportional to the weight. Was so satisfied of the advantage of the atmospheric, that he had proposed to adopt it on the line (26 miles) he was now surveying from Croydon to Chatham. An advantage of the atmospheric was, that when a train stopped at the station, the power for propelling was accumulating in the pipe, so as to bring the train more rapidly into motion from the state of rest. Witness's preference of the atmospheric was limited to cases where the passage of trains was required to be frequent. Had no hesitation in saying, that if the two lines now before the committee were to be worked by locomotive power, the Southwestern would be the cheapest and safest; but if the atmospheric were applied, it could be done cheaper by the Croydon and Epsom. Had no doubt but that the atmospheric upon a single line, where everything was adapted to it, was much safer than a locomotive on a single line with double power. The atmospheric might be so managed that no carelessness could produce a collision; but it was impossible on a locomotive line to prevent one train catching or meeting another. Thought that the leakage could safely be neglected. Did not think that any experiments which had yet been made would enable a correct calculation to be made of the amount of power required to overcome the leakage. He spoke guardedly and carefully, inasmuch as he was expressing an opinion adverse to that of his friend, Mr. R. Stephenson, whose report he had seen. Thought there was no difficulty in constructing carriages in the manner stated by Mr. Cubitt, by bringing them at once on slides or sledges, or by locking all the wheels of one entire train, which, now that they used steel tires, he should not be afraid of doing. Thought there would be no difficulty at all in keeping the atmospheric railway in such good order that the carriages might be better constructed and connected one with another, so that the break might be made to act in the whole at once. There had lately been introduced a new mode of valve-gearing, which facilitated the adaptation of engines to the load. The practical effect of the expansive gear was rather to put larger cylinders on the engine, and to work economically, than to vary the power much, because the variation of power between shutting off the steam was not very great. The sole object of this improvement was, by the use of a rather larger cylinder than was necessary to enable the steam to be used expansively, and thereby obtain economy of fuel. Was among the first to use the expansive gear on the Great Western, but had no such object as the saving of steam in going down an incline, in order to reserve it for use in going up an incline. Had advised a line between Chatham and Croydon to be laid down on that principle, and also between Genoa and Turin, which was over a steep part of the Apennines. Witness wished to be allowed to explain himself more particularly on one point, as he was now giving an opinion professionally, and more particularly as a report had just been published by an eminent—probably the most eminent—man in his own profession, in which a strong opinion was expressed on all these points diametrically opposite to those which he entertained. He should wish it to be understood that he was not

carelessly giving any opinion now without recollecting that circumstance, and he should, in his own vindication, repeat the object of his making the experiments at Dalkey, and also say, with sentiments of much respect for Mr. Robert Stephenson, that he still thought it possible to form a more correct opinion on this particular case by a general practical view of the working of the Dalkey line, and of the modifications of which it was susceptible when applied to longer lines, than by the very minute calculations and minute experiments recited in Mr. Stephenson's report. In the first place, the Dalkey line was too short, and, he must say, too badly constructed, owing to local difficulties, to allow either velocity to be attained or the train to be worked, with ordinary average resistance. Believed that resistance upon that line was much greater than it was on a good railway, and that there were sources of great loss of power in the connecting pipe and other parts which, according to his opinion as a mechanical man, might be easily remedied and overcome.

Mr. R. Stephenson's objections will be found substantially in the following extracts from his report, for which, as well as for the preceding abstract we are indebted to the Railway Chronicle.

"My first impression was that much higher velocities were attainable by the atmospheric system than had yet been accomplished by locomotive engines; but a very careful reflection upon all the circumstances which the last series of experiments developed and, the detailed calculations which have been made upon them, has led me to alter that impression. I am fully aware that the calculations which have been given do not absolutely put a limit to the speed, and that the investigation may resolve itself merely into a question of power, and consequently into one of expense; to a certain extent, this is the case, but an inquiry of this kind, which is as essentially commercial as scientific, is one in which pecuniary limits must continually present themselves, and not unfrequently prove more formidable than those of a mechanical nature. In pursuing my calculations, therefore I have felt that it was imperative to determine with some accuracy the probable additional power which it would be necessary to reckon upon, beyond that which has been employed at Kingstown; and I am convinced the increase which has been stated as requisite to attain the assumed velocity of 50 miles per hour is rather under than over estimated; and this single example, based as it is entirely upon experimental data, is sufficient, in my opinion, to demonstrate conclusively, that any velocity beyond that which is now frequently attained upon railways, must be attended with a most inordinate waste of power. I have already contrasted the actual velocities of the trains with those which would be indicated by theory, and have shown that the loss of velocity arises solely from the leakage of the apparatus, and that as the rarefaction is increased this content of leakage becomes augmented, while the pump is only capable of exhausting a constant content of air without reference to the density. This leads us to the conclusion that when the barometer rises to within a few inches of its utmost height, the expansion of the air leaking into the apparatus must become fully equal to the total capacity of the pump, and no advance of the tube piston can be effected. The case occurs on the Kingstown and Dalkey railway, with a height of barometer of 25¼ inches, which is the maximum height that can be attained in the entire length of the vacuum tube; and therefore a train requiring this height of barometer could not be started if the air pump did not exceed its uniform rate, although the engine would be working at almost its greatest power. This conclusion, which is unques-

tionably correct, points out the improvident expenditure of power when a high degree of rarefaction is required."

Having thus removed the great claim made by the inventors to the exclusive enjoyment of high velocities, Mr. Stephenson next proceeds to compare the work actually done by the atmospheric system on the Dalkey line with the work actually done by *stationary power and rope system*, as now in use at Camden-town. The comparison is fair, in this respect, that the Camden-town incline is 1 in 106, and the Dalkey incline is 1 in 115 being in favor of the atmospheric; only there are sharp curves on the latter, which do not exist on the former. The results of the comparison may be arranged under several heads, as follows:—

1. *Loss of power* by rope and atmospheric tube:—

"In proceeding to compare with these the results of the experiments on the atmospheric railway, it is my object to select a case in each, which shall present the closest analogy in the amount of their resistances and velocity. The 4th train in table No. VII, and the 18th in table No. V, correspond very closely in these particulars, the total resistance of the former, including the friction, gravity, and resistance of atmosphere, being equal to 102 horses' power, and of the latter, 100 horses' power, and the respective velocities being 20 and 18 miles per hour. The loss of power from the working of the rope in the former case is equal to 30 per cent. of the total, while the loss in the latter, arising from raising the vacuum, leakage, and imperfections of the apparatus, amounts to 74 per cent. of the total power. In order however, to institute a correct comparison between these two cases, the total power in the former must be increased in the proportion of the mean to the maximum velocity, which in this instance is ascertained, from experiments made, to add 37 horses' power to the total, and the comparison stands thus: the loss of power on the Euston incline amounts to 45 per cent., while that on the Kingstown and Dalkey railway is 74 per cent. The result is obtained with a train which represents the average working of the Euston incline; it is therefore evident that in this particular instance the rope is very considerably more economical than the atmospheric system. If we assume other weights of train, we shall perceive, that as they become lighter the proportion of loss by the atmospheric apparatus will be diminished on account of the reduction in the effect of leakage accompanying the reduction in pressure, but the proportion of loss by the rope will be increased, as the power required to work the rope itself is the same with a light as with a heavy train; while on the other hand, with heavier trains the proportion of loss by the rope will be diminished, and that by the atmospheric system greatly augmented, from the increased effect of the leakage, and the additional power required to raise the vacuum to a greater height."

2. *Consumption of fuel* by the rope system and the tube system compared:—

"This I am enabled to accomplish from the observation of a fortnight's working of the Euston incline, and from an experiment on the Kingstown and Dalkey railway, in which the number of trains, the exact weight of each, and the consumption of fuel, was ascertained during an entire day. The result of the former was, that 13 trains averaging 41 tons each, the mean resistance of which amounted to 1590 lb., were drawn up the incline of 0·91 mile length, at a mean velocity of about 17 miles per hour, in one day of 15 hours, with a consumption of 30 cwt. of coal; and the result of the latter was that 10 trains averaging 44 tons each, the mean resistance of which amounted to 1205 lb., were drawn up the incline of 1·22 miles

length, at a mean velocity of about 14 miles per hour, in one day of eight hours, with a consumption of 29 cwt. of coal. The consumption of coal per mile of the trains in these two cases amounts to 284 lb. on the Euston incline, and 266 lb. at Kingstown; and dividing these by their respective amounts of friction and gravity, we obtain the comparative consumption per lb. of tractive force as ·18 lb. in the former case, and ·21 lb. in the latter."

3. Power of *overcoming bad gradients*:—

"If we take some of the trains which are drawn up the Euston incline, amounting to fully 100 tons weight, we shall find that the total resistance exceeds the capacity of the tube which is employed at Kingstown, namely, 15 inches diameter; for supposing the pressure to be equal to 22 inches height of the barometer, or 11 lb. per square inch, the train just named upon the gradient of 1 in 75, which is near the upper end of the Euston incline, and continues for about one-third of its length, would offer a resistance, at a velocity of 17 miles per hour, of about 4,500 lb., and would therefore require a tube of 23 inches diameter. Such an increase of tube, it must be observed, immediately implied a great reduction of velocity with the atmospheric system, or an increased size of air pump, involving a corresponding increase of power, because the ratio between the areas of the air pump and vacuum tube is affected; and it has been clearly shown that, working at a high vacuum in a small tube, or increasing the size of the tube and lowering the vacuum, if the same amount of power be employed, involves equally the sacrifice of velocity. Here we perceive a decided proof, that what is termed good gradients is not a matter of indifference to the atmospheric system, and that we shall not be justified in attributing to it the power of economising the construction of railways to any considerable extent, by avoiding the necessity of levelling the face of the country."

The comparison with the locomotive, even in duty alone, is also of a kind unfavorable to it, keeping out of view altogether the peculiar disadvantages of stationary as compared with locomotive power. The result is as follows:

"If we convert the loads moved in the experiments into equivalent loads on a level, we shall then find that in no case they exceed the duty which is being daily performed by locomotive engines. Thus, taking experiment No. 4, the load being 26·5 tons, the resistance per ton upon an incline of 1 in 115, at a velocity of 34·7 miles per hour, estimating the resistance of the atmosphere according to Lardner's experiments previously referred to, will stand thus—gravity, 20 lb. per ton; friction, 10 lb.; atmosphere, 20 lb.: total resistance, 50 lb. per ton. And the resistance upon a level will be—friction, 10 lb. per ton; atmosphere, 20 lb.: total resistance, 30 lb. per ton. Therefore this train of 26·5 tons, on the incline of 1 in 115, will be equivalent to 44 tons upon a level, at the same speed of 34·7 miles per hour. This duty, which is indisputably the utmost given by the experiments at Kingstown, is much exceeded daily on many lines of railway in this country, and especially by the Great Western, and Northern and Eastern. Throughout the experiments, it will be seen that the duty performed by the Kingstown and Dalkey engine, when reduced to an equivalent level, falls short of the daily performance of locomotive engines on our principal lines of railway, both as regards speed and load."

The conclusion of the whole matter, considered as a purely mechanical question, is given in the following sentences:—

"On a long series of bad gradients, extending over several miles, where the kind of traffic is such that it is essential to avoid intermediate stoppages, the atmospheric system would be the most expedient. If, however, intermediate stoppages are not objectionable, as is the case in the conveyance of

heavy goods and mineral trains on the railways in the neighborhood of Newcastle-upon-Tyne, the application of the rope is preferable to the atmospheric system. This conclusion I conceive to be fully established by the comparison which has been made between the Kingstown and Euston inclines. Again, on lines of railway where moderate gradients are attainable at a reasonable expense, the locomotive engine is decidedly superior, both as regards power and speed, to any results developed or likely to be developed by the atmospheric system. In considering these last, as well as all the preceding calculations and remarks, it must be borne in mind that they have reference solely to the question of power, and are entirely independent of the question of expense or convenience: the next step in the inquiry will therefore be, the expense of constructing the lines on each system and the probable cost of working."

Hitherto the question has been treated wholly as one respecting the value of a given mechanical means of transmitting power.

There remain to be considered the questions of *cost and convenience;* and here, as well as throughout the whole line of argument, there will be observed a close analogy between the results and reasonings of Mr. Stephenson's report and those in pp. 102, 103 of our last, already referred to.

The inventors of this system, in vaunting its excellence, rely much on the supposed advantage of being able to work with single lines. This Mr. S. completely refutes: he proves the necessity, not only of two lines, but of duplicate engines. This raises the cost of the atmospheric to £11,000 per mile; so that on such a line as the London and Birmingham, the total cost, in all items, for locomotive power, is - - - £321,974
and for the atmospheric, - - - - 1,221,000

But even the expense of working, after all this greater expenditure of capital, is against the atmospheric.

The cost of locomotive power upon the London and Birmingham railway, for 1843, was as follows:—

"Wages of engine drivers and firemen, - - -	£9,673	
Coke, - - - - - -	25,541	
Oil, horse pipes and fire tools, pumping engines and water, -	4,099	
Laborers and cleaners, waste and oil, - - -	4,194	
Repairs of engines and tenders, - - - -	12,521	
Coals and fire wood, expenses of stationary engine at Wolverton, repairs of buildings, gas and incidental charges, - - -	3,172	
Superintendent, clerks' and foremen's salaries, and office charges,	4,634	—£63,834

The expense of working the atmospheric system for one year, I estimate approximately as follows:—

"Wages of engine men, 64 at 6s.; stokers, 64 at 3s., -	£10,512	
The same during the night, - - - - -	10,512	
Coal, 172 tons per day, at 9s., - - - - -	28,332	
Oil, hemp, tallow and repairs at 5 per cent. on cost of engines, -	20,000	
Superintendence same as locomotive, - - -	4,634	—£73,990

I have already stated that the above sum has no pretension to precise accuracy, but since I have intentionally omitted numerous items of expense, which must arise (the exact amount of which no one can venture to predict or to introduce into such a calculation with much confidence,) I prefer making the comparison under that aspect which is the most favorable to the new invention under discussion; because I conceive the question between the atmospheric and locomotive systems does not by any means, after what has been advanced, depend on the mere annual cost of working. I shall content myself with the above statement, which in my opinion sufficiently establishes the fact, that the cost of working the London and Birmingham

railway, or any other line with a similar traffic, by the atmospheric system would greatly exceed that by locomotive engines."

But, to do the system full justice, a single line, the favorite instance, may be taken at their own estimates; and the result entirely coincides with that given by our correspondent S., in our last.

"Let us now conceive it applied to a case of an opposite character; for example, the Norwich and Yarmouth railway, which has cost about £10,000 per mile, including carrying stock and every appurtenance. This line passes over a country in which the application of the atmospheric system could have effected no economy in the formation of the line, which has not exceeded a cost of £8,000 per mile. The application of a single line of the atmospheric apparatus would, in this instance, have added at least £5,000 per mile, which upon 20 miles, the length of the railway, would amount to £100,000. The mere interest of this sum, at 5 per cent. is £5,000 per annum, whereas the actual working of this line, including maintenance of way, booking offices, porterage and all other constant traffic charges, has been let for £7,000 per annum, being only £2,000 above the bare interest of the extra capital which would be required to lay down the atmospheric apparatus; an amount which would be quite inadequate to meet the wear and tear of the machinery alone, leaving nothing to meet the current cost of working. Here, therefore, we have a case, where the country is favorable, the original capital small, and the traffic moderate, where the cost of the atmospheric system would be so burdensome as to render it totally inapplicable."

In the appendix, the comparison of the atmospheric system with that on the Blackwall railway is given with great clearness by Mr. Bidder, and leads to this conclusion, that—

"Unless some expedient with which I at present am unacquainted can be devised for obviating the necessity of stopping at each intermediate station, it would appear that the trains could not be run more frequently than at half hour intervals with the engines now at work, thus reducing the trains to one half their present number, and this, too, without effecting any saving in the working expenses, inasmuch as there would be no reduction in the staff of conductors while the constant and severe breaking would increase the cost of maintenance of way and carriages; the wages of the rope men also would not compensate, for the extra cost arising from the engines being kept continually at work, instead of for ten minutes only out of every quarter of an hour, as is now the case; and lastly, the interest of the outlay requisite to introduce this system would exceed the annual cost of reparing and replacing the rope."

Mr. Stephenson sums up the whole case thus:—

"1st. That the atmospheric system is not an economical mode of transmitting power, and inferior in this respect both to locomotive engines and stationary engines with ropes. 2nd. That it is not calculated practically to acquire and maintain higher velocities than are comprised in the present working of locomotive engines. 3d. That it would not in the majority of instances produce economy in the original construction of railways, and in many would most materially augment their cost. 4th. That on some short railways, where the traffic is large, admitting of trains of moderate weight but requiring high velocities and frequent departures, and where the face of the country is such as to preclude the use of gradients suitable for locomotive engines, the atmospheric system would prove the most eligible. 5th. That on short lines of railway, say four or five miles in length, in the vicinity of large towns, where frequent and rapid communication is required

between the termini alone, the atmospheric system might be advantageously applied. 6th. That on short lines, such as the Blackwall railway, where the traffic is chiefly derived from intermediate points, requiring frequent stoppages between the termini, the atmospheric system is inapplicable; being much inferior to the plan of disconnecting the carriages from a rope, for the accommodation of the intermediate traffic. 7. That on long lines of railway, the requisites of a large traffic cannot be attained by so inflexible a system as the atmospheric, in which the efficient operation of the whole depends so completely upon the perfect performance of each individual section of the machinery."

Mr. Herapath takes strong ground against the atmospheric railway, and speaking of the great loss of power from the friction of the air in the pipes, says:—

"That I am not unsupported in the views of the inefficiency of these atmospheric machines, I shall show by a quotation, furnished me a few days ago by a friend, from Dr. Robison's Mechanical Philosophy. The first experiment was made by Papin, an able man of science and a very eminent engineer. The second seems also to have been made by a good engineer and it is therefore presumed that both of these facts ought to be well known to our engineers of the present day. It is to be lamented that the size of the tubes is not mentioned, but doubtless they were small, perhaps only a few inches in diameter. As bearing, however, on the general question of the great amount of friction of air in tubes, it is not material to know the exact size.

"Dr. Papin, a most ingenious man, proposed this (the motion of air in pipes) as the most effectual method of transferring the action of a moving power to a great distance. Suppose for instance, that it was required to raise water out of a mine by a water machine, and that there was no fall of water nearer than a mile's distance. He employed this water to drive a piston, which should compress the air in a cylinder communicating by a long pipe, with another cylinder at the mouth of the mine. He expected that as soon as the piston at the water machine had compressed the air sufficiently, it would cause the air in the cylinder at the mine, to force up its piston, and thus work the pump. Dr. Hooke made many objections to the method when laid before the Royal Society, and it was much debated there. But dynamics was at this time an infant science, and very little understood. Newton had not then taken any part in the business of the society, otherwise the true objections would not have escaped his sagacious mind. Notwithstanding Papin's great reputation as an engineer and mechanic, he could not bring his machine into use in England: but afterwards in France and Germany, where he settled, he got some persons of great fortune to employ him in this project; and he erected great machines at Auvergne and Westphalia, for draining mines. But so far from being effective machines, they would not even begin to move. He attributed the failure to the quantity of air in the pipe of communication, which must be condensed before it can condense the air in the remote cylinder. This indeed is true, and he should have thought of this earlier. He therefore diminished the size of this pipe and made his water machine exhaust instead of condensing, and had no doubt but that the immense velocity with which air rushes into a void, would make a rapid and effectual communication of power. But he was equally disappointed here, and *the machine at the mine stood still as before.*

"Near a century after this a very intelligent engineer attempted a much more feasible thing of this kind at an iron foundry in Wales. He erected

a machine at a powerful fall of water, which worked a set of cylinder bellows, the blowpipe of which was conducted to the distance of a mile and a half, where it was applied to a blast furnace. But notwithstanding every care to make the conducting pipe *very air-tight, of great size, and as smooth as possible*, it would hardly blow out a candle. The failure was ascribed to the impossibility of making the pipe air-tight. But what was surprising, above ten minutes elapsed after the action of the piston in the bellows, before the least wind could be perceived at the end of the pipe; whereas the engineer expected an interval of six seconds only."

It was our intention to have offered some remarks of our own on this novel and extraordinary project; but when we find such men as R. Stephenson and Brunel entertaining diametrically opposite opinions after actual examination, we think it will better become us to merely submit their views to our readers. The cost alone will prevent the possibility of its adoption on the vast majority of roads in this country, though we think that the coal region of Pennsylvania affords some suitable openings.

It will be seen that Mr. Stephenson deduces all his conclusions from his own experiments, considering them as infallible, while Mr. Brunel founds his opinion on what—judging from the present state of things—may reasonably be expected from experience skill and observation, and we think this is with *practical* men the safer mode.

CENTRAL RAILROAD, GEORGIA.

This important work, the longest railway in existence, is now completed and the following extracts from the report of the engineer, Mr. L. O. Reynolds, will give our readers a good idea of the railway generally.

"The quantity of excavation and embankment throughout the whole line is about five million six hundred thousand cubic yards. There are, including the long bridge over the Oconee swamp, about six miles in extent of trestle bridging; about one-third of this may be, at a future day, filled up with earth.

"The road-bed is graded to a width of 15 feet on the embankments, with slopes of one and a half base to one vertical. The excavations below station No. 10, are generally graded 25 feet wide; beyond that station, 20 feet; side slopes generally, 45 degrees—except in loose soils, when they are similar to the embankments, and in some instances two to one.

"There has been no rock excavation of consequence, but many of the cuts have been through a compact mixture of clay and sand, which required the aid of the pick in excavating.

"Considerable work will be necessary during the present and next years, in extending and perfecting the drainage of the road. Nothing is more important than good drainage to insure a firm and even track.

"The maximum inclination of grade of the road is 30 feet per mile. Although I have inserted a table of the gradients and curves of the road in a former report, I will repeat that they may be classed as follows:

	Miles.	Feet.
Level, - - - - - -	26	4,378
Inclinations not over 5 feet per mile,	44	4,880
" from 5 to 10 " "	30	4,600
" " 10 to 15 " "	17	4,240
" " 15 to 20 " "	13	3,160
" " 20 to 25 " "	9	3,880
" " 25 to 30 " "	47—190	210—1,600

"The following table exhibits the proportion of straight and curved line, with the various radii of the curves. Number of curves, 109; number of straight lines, 110.

Length of Radius.	Number of Curves.	Aggregate Distance.
2,000 feet.	25	42,835 feet.
2,100 "	4	9,802 "
2,300 "	2	3,943 "
2,500 "	5	8,138 "
3,000 "	13	20,788 "
3,500 "	6	13,781 "
4,000 "	12	25,683 "
4,500 "	2	4,980 "
5,000 "	15	45,729 "
7,000 "	2	3,656 "
8,000 "	5	15,312 "
10,000 "	8	28,100 "
15,000 "	5	21,916 "
16,000 "	1	7,139 "
20,000 "	1	8,374 "
30,000 "	2	6,920 "
150,000 "	1	26,500 "
Total,	109	293,596 "
Total length of curved line,	55 miles, and	3,156 "
" " straight line,	134 " "	3,724 "
Whole length of road,	190 " "	1,600 "

The summit is 464 feet above tide, and the level of the Ocmulgee bridge (floor) is 297 feet above tide. This bridge we take to be the western terminus of the road.

"The plan of superstructure for one hundred miles from Savannah, is as follows:

"Cross sleepers are first bedded in the ground and rammed solid, their upper surfaces being level with the grade of the road; string pieces, 6 in. deep and 12 in. wide, are then trenailed flatwise on the sleepers, and the ground rammed under them, affording a continuous bearing. On the top, and in the centre of these string pieces, is placed a small lath or ribbon, 3 by 2 in. of hard pine; and this is surmounted by the plate, or strap rail of iron, 3 in. wide by ¾ in. thick. The iron is confined by spikes 7 in. long, passing through the ribbon into the string piece. Wrought iron splicing plates, ¼ in. thick, are placed under the joinings of the bars, the spikes passing through them. The balance of the road above the 100 mile station is similar, excepting that a light T rail is laid on the string piece, instead of the ribbon and plate rail.

"Total cost of the road, $2,581,723. This amount is made up of various items, which may be set down as follows:

"Grading, including grubbing, clearing, excavation, embankment and wooden culverts,	975,898
Culverts of masonry,	49,000
Depot at Savannah,	33,078
Depot at Macon,	24,767
Bridges, including Oconee, which cost $70,000,	126,000
Laying superstructure, and materials, except iron,	424,400
Wells, pumps and cisterns,	4,600

Iron rails, spikes and plates,	476,081
Damage by freshet of 1841,	68,000
Right of way,	36,153
Engineering, including preliminary surveys,	154,530
Motive power and cars,	168,343
Tools, machinery, etc., in shops,	15,000
Incidental expenses,	25,873
	$2,581,723
"Average cost of road per mile, exclusive of motive power,	$12,702

"Since the date of my last report, we have increased our motive power by the addition of six freight engines of the second class, making our number now 14, viz: 8 third class 6 wheel engines, 5 second class 8 wheel freight engines, 1 second class 6 wheel connected freight engine; all of which are in running order, except one. These engines have performed from the 1st November, 1842, to 1st December, 1843, a total distance of 181,954 miles.

"The whole amount of fuel consumed in performance of the above distance, was 2,739 cords of wood, being an average of 66·43 miles run for every cord of wood consumed.

"Two additional freight engines, and the wheels, etc., for fifty burthen cars, have been ordered, and will be received in time to meet the business of the next fall.

"This will swell the number of eight wheel burthen cars to upwards of one hundred and fifty."

The receipts for 13 months ending Nov., 1843, were $227,531 94, of which $37,329 37 were from passengers, $17,517 76 from the U. S. mail and the remainder from freight. Number of passengers, 10,461, of bales of cotton 47,133.

The expenses for that period have been as follows:

"Repairs of the road,	61,886 89	
Tools and materials for repairs of engines and cars,	3,175 08	
Salaries,	9,885 32	
" way stations,	8,276 53	
Oil and tallow,	1,237 75	
Fuel and water,	11,477 39	
Labor, provisions and forage,	2,578 14	
Damage,	1,338 82	
Insurance on cotton,	1,352 19	
Machinists, runners and firemen,	15,194 12	
Carpenters,	2,266 67	
Blacksmiths,	1,773 78	
Conductors and train hands,	11,935 77	
Incidental expenses,	2,042 99	—134,341 43
Leaving a nett profit, of		$93,190 51

"The comptuation of profits, receipts, etc., is made up to Dec. 1st, being one month over a year, that the accounts may correspond in date with those of the bank for the future."

The receipts for the three following months, were $86,716 73.

"It will, no doubt, be observed that, in the account of expenses, the items of repairs of road is much increased over last year. We have most sensibly felt the benefit of increasing the outlay for this purpose in the improved

condition of the road, and the regularity with which our trains perform their trips.

"In order however, to show that the expense of this particular branch of the service is still within moderate limits, I may here mention that the annual cost of repairs of our road average - - $317 per mile.

South Carolina railroad,	372	"
Georgia railroad,	303	"
Average of eight principal railroads in Massachusetts,	477	"
" Western railroad,	310	"

"The expense of working our road per mile run, during the above period, has been - - - - - - 73·8 cents."

HOUSATONIC RAILROAD REPORT.

We have the report of this company, dated 24th June, 1844, and make such extracts as will interest our readers. It is mainly occupied by the financial affairs of the company.

"The entire length of the Housatonic railroad, from the tide water at Bridgeport to the north line of the State of Connecticut, is 73$\frac{20}{100}$ miles. In this distance there are twelve regular stations, for the receipt and discharge of passengers and freight, namely, at Stepney, Botsford's, Newtown, Hawleyville, Brookfield, New Milford, Gaylord's Bridge, Kent, Cornwall Bridge, West Cornwall, Falls Village and North Canaan. The maximum grade is 40 feet to the mile, but more than half the length of the road is passed on grades of under 26 feet to the mile.

"The following expenditures have been made in the construction of the road and appendages.

"Obtaining charter, preliminary surveys, etc., - -	6,150 32
Right of way and land damages, - - - -	60,051 43
Grading and superstructure, - - - -	967,005 60
Engineering, - - - - - -	24,407 23
Turntables, - - - - - -	1,493 64
Engine houses, - - - - - -	4,383 68
Construction of Depots, etc., - - - -	11,733 70
Profit and loss, - - - - - -	46,770 53
Contingent expenses, - - - - -	23,097 32
Real estate, - - - - - - -	1,669 80
Engines and cars, - - - - -	97,359 66
	$1,244,122 91

"This expenditure of $1,244,122 91, for a road of 74 miles in length, with an ample outfit of engines and cars, will bear favorable comparison with any other railroad in the United States, of similar construction."

"The Berkshire railroad company, chartered by the State of Massachusetts, with a capital of $250,000, all paid in, constructed their road from the northern termination of the Housatonic road to the village of West Stockbridge. There are four regular stations on this road—at Sheffield, Great Barrington, Van Deusenville and West Stockbridge. Its entire length is 21$\frac{14}{100}$ miles. The grades are similar to those on the Housatonic road. The use of the road is granted to the Housatonic railroad company during the term of the charter, at an annual rent of $17,500, payable monthly. The road is to be kept in repair by the lessees, and in effect the Housatonic railroad company possess as complete control over it, as if it had been constructed under their own charter. The rent is paid in full, and is considered as one of the charges of monthly expense and settled accordingly. The

Berkshire company have the right to increase capital to $600,000, and an arrangement may be made for the issue of stock to an amount which may be necessary for substituting heavier rail, upon adding to the rent paid by this company a sum equal to seven per cent. upon the expenditure. This insures a superstructure equal to any which may be adopted on the Housatonic road, whenever a new and stronger rail may be laid on that road. From West Stockbridge, the line is continued to the Western road, by the West Stockbridge company, a distance of about 2¾ miles. That road is leased to the Housatonic railroad company, for the term of the charter, at an annual rent of about $1000. One half of the expense of the maintenance of the road is to be paid by the lessees. Provision is made in the lease, by which an edge rail may be laid by the Housatonic railroad company; in which case an allowance equal to one half of the average repairs of the present road, is to be made to the Housatonic railroad company."

"Receipts of	1842.	1843.	1844.
January,	$8,072 85	$11,826 87	$15,305 07
February,	6,011 75	10,212 36	15,534 03
March,	6,083 41	13,563 93	14,065 47
April	5,779 23	9,738 24	10,101 06
May,	6,363 03	10,310 64	13,142 67
Total 5 months,	$32,310 27	$55,652 04	$68,148 30

RAILWAYS IN MICHIGAN.

The rapid increase of income on these works, is truly gratifying. The Central railroad is to be opened very soon to Kalamazoo and this, the commissioners say, will itself pay the interest on the State debt.

They complain much of the heavy duty lately imposed on railroad iron.

"The tariff of 1842 placed a cash duty of $25 per ton on railroad iron, which prevented the commissioners from importing it, as they were unable to make payment of so large a proportion of the cost of the iron on its arrival in this country. The low price of iron in England would have enabled them to have imported it to great advantage had it not been for the heavy duty placed upon it, for the first time, by the act of 1842. This duty is a serious obstacle to the extension of our railroads, and the commissioners would respectfully suggest to the legislature the propriety of endeavoring to have the tariff act so modified, as to allow its importation free of duty, as heretofore, particularly for roads which had been commenced while such permission was allowed."

Of the Southern railroad they say:

"This road was ironed and put in operation to Hillsdale, 68 miles from Monroe, early in October, since which time all the locomotive power on the road has been fully employed, and a large amount of produce remained on hand at the different points on the road which it was impossible to transport in time for shipment to the east, for a want of machinery and cars. The limited means the board then had control of, not enabling them to provide in season the necessary facilities for doing all the business that was offered. Two new locomotives have been placed upon the road and a sufficient number of cars will be prepared in season, to do all the business that offers during the coming year. The difficulties which have heretofore prevented this road from producing any revenue, have now been principally overcome. The facilities for shipment of produce at its eastern termina-

tion, have much increased, and by its extension west of Adrian, the competition with the Toledo road is obviated."

The following extract from the report of Mr. Berrien, the chief engineer, is interesting. Speaking of the "warrants" in which the contractors are paid, he says:

"For all purposes except the purchase of a few things considered as cash articles, they are used to much better advantage, and being the same as cash to those who use them for the purchase of public land, a great many are induced to seek employment upon the road for the purpose of applying the proceeds of their labor, and obtaining land, which probably they could not obtain in any other way. In addition to the above is the fact that but little money is used at present in payment for labor of any kind, also helping to increase the demand for work upon the railroad, and the effect of competition has been a very great reduction in prices.

"Were money to be used we should undoubtedly be able to make more rapid progress; yet, with the exception of the time required, it is matter of doubt whether the road could be carried on to much greater advantage with money than is now being done with warrants. At any rate, there is no doubt of the fact, that the greater part of the work, and grading especially, is done at present at much lower rates in warrants than were paid for similar work, a few years ago, in cash."

ON PLANK ROADS IN CANADA.

Lord Sydenham, during his long sojourn in Russia, travelled on several of them, and found them well adapted to the circumstances and the climate; and, as both were very similar to those in Canada, he was strongly of the opinion that their introduction there would greatly conduce to the public interest. A few miles of road in the neighborhood of Toronto was first laid with plank by the local commissions who had the management of it. The cost of stone and the great, expense they had been at in macadamizing a portion of the same road, as well as the heavy annual repairs, had induced them to try the experiment in that province of laying a planked surface on the road. A gentleman describing it, says: "The few miles nearest the city, and over which very considerable traffic existed, were planked; and, upon inspection, it was found the top surface of the timber was worn in the centre for the breadth of 7 feet, and to the depth of $\frac{5}{8}$ of an inch; the ends being to the full dimensions as the plank came from the saw. The bottom or under side of the planks, was found throughout perfectly sound. In two or three places, where a small cavity was left by the foot of a horse or other animal, there was found a slight pinkish tinge corresponding with the cavity, and indicating the commencement of fungus. The sleepers appeared perfectly sound." The facts elicited by examination of the portion of the road laid down but one season, were the same as the foregoing, except that but $\frac{3}{8}$ of abrasion had taken place. From the foregoing, it will be seen—

1st. That the wear and tear of the plank road, even near a populous town, is confined to the 7 feet in width of the centre.

2d. That, for the preservation of the planks from decay underneath, it is indispensable that every portion of it be solidly imbedded in the formation.

3d. That considerably more than half the wear and tear which occurs in seven years' use of the road, takes place the first year; which is easily accounted for, by the natural stripping off while the plank is fresh, of those fibres which were cross-cut by the saw; and from the fact of the dung of the cattle getting bound with the raised fibre of the wood and thus forming

a tough elastic covering, which saves the plank in a great measure, from the effects of the horse's shoes, and the tire of the wheels. On this road the plank is 16 feet long, 3 inches thick, laid crossways at cross angles to the road, on 5 sleepers of pine 5×3 laid on edge, and in the line of the road; and this was considered the best mode of laying a plank road, except that on a country road plank 8 or 10 feet long will be found quite sufficient. On the Chambly road (plank) the planks are 12 feet long, but laid diagonally, so as to make the road but 8 feet wide. This was opposed by some, and very justly; for, as apprehended, the weight of half the vehicle and load coming suddenly on one end of the plank, and the other end not being kept down at the same time, the traffic constantly tends to disrupt the road, and the planks are loose, and spring from end to end. Another principle connected with the laying of this road, (which was opposed) is that of having the sleepers of much larger scantling than on the Toronto road. It was remarked that, as all earth formation under a road of this nature will more or less subside and shrink, the giving to the sleepers too much area would enable them to bear up the plank, leaving the earth to settle from them, thereby causing springing in the plank, which tends greatly to their being cut away; (in fact, they quickly become rounded from the edges;) and, also, that fungus and decay of the plank would be brought on, in consequence of the confined air below. These apprehensions are realized. At Quebec, part of the road has been planked, the plank being laid lengthwise of the road. It was considered that the planks would stand better the friction, and, when necessary, could be more easily taken up, and the road repaired. One strong objection to this mode of laying the plank is found to be, that the horses cannot keep their feet when much weighted, and are much exposed to falling, in consequence. Under all the circumstances, most have approved the manner in which the planks are laid on the Toronto road. Those now being planked under the department in the western section of the province are so laid, except that the planks are spiked with a 5½ inch spike—one in each end. With respect to plank roads generally, I wish none to suppose that I am an advocate for their adoption, except in those sections of the country where nature has afforded no better material, and where funds can be obtained for a better structure. There are stretches of 30 and 40 miles, in parts of the west, where the soil is a deep rich vegetable mould, and without stone or gravel of any description; in such cases you must be content to wade through the mud, or adopt the plank roads. When the traffic or intercourse of a section of country requires that good roads should be afforded for it, the adoption of plank or stone roads should be governed simply by a comparison of the first cost of each, in conjunction with the probable annual expense of repairs; and if this comparison is based on the plank lasting 12 years, (or some say 10 years,) a safe conclusion will be arrived at. In some cases in Canada, the adoption of plank instead of stone would have made such a saving as would have replanked the road every five years, if necessary. There are many sections in the west, where timber abounds, especially in Ohio, Indiana and Kentucky, where such roads might be introduced with great advantage.

GEORGIA RAILROAD.

In our last we gave extracts from the report of Mr. Thompson containing numerous details of interest to the profession, but to render the account of this specimen of civil (not political or State) engineering complete, we copy the following tables of receipts and expenditures for upwards of 6 years.

STATEMENT of the YEARLY EXPENSES incurred for WORKING the GEORGIA RAILROAD, from April 1, 1839, to April 1, 1844.

	Year ending April 1, 1840.		Year ending April 1, 1841.		Year ending April 1, 1842.		Year ending April 1, 1843.		Year ending April 1, 1844.	
CONDUCTING TRANSPORTATION.	Dolls.	Dolls.	Dolls.	Dolls.	Dolls.	Dolls.	Dolls.	Dolls.	Dolls.	Dolls.
Stationery and printing,	589 55		475 04		777 59		586 69		1,194 04	
Loss and damage,	1,666 93		738 67		1,909 18		382 34		2,248 48	
Incidentals,	1,101 31		883 45		1,624 68		1,866 08		1,755 26	
Oil and tallow for cars,	288 61		182 78		402 72		410 97		342 63	
Provision, clothing, etc., for negroes,	4,041 57		2,593 98		2,849 42		2,862 07		2,726 00	
Expenses of Warrenton branch,	360 25		799 43		1,062 62		591 10		772 42	
Expenses of horse car—Athens branch,					583 34		2,336 33		1,352 49	
Wages laborers,	4,522 59		2,355 11		2,022 24		3,958 23		4,111 31	
Agents and clerks,	7,467 89		7,356 39		8,742 88		9,329 42		9,289 19	
Conductors,	3,927 81		2,484 75		2,024 83		2,663 79		2,796 79	
Work done by car factory,					220 50		152 50		223 00	
Work done by machine shop.					480 00		31 50		91 00	
		23,966 51		17,896 60		22,699 97		25,170 02		26,902 61
MOTIVE POWER.										
Stationery and printing,	59 17		16 25		13 08					
Expenses of water stations,	3,009 40		2,480 98		2,518 11		2,061 12		1,963 14	
Incidentals,	70 82		27 95		329 49		184 62		255 19	
Fuel,	6,839 24		5,402 87		7,186 61		6,405 12		2,652 17	
Oil and tallow for engines,	3,108 84		1,177 54		1,538 73		1,411 34		1,459 46	
Ordinary and extraordinary repairs to engines,	6,403 38		6,792 19		9,610 28		7,866 90		5,658 40	
Improvements to engines,							2,288 00		1,632 50	
Engine drivers and firemen,	7,523 73		4,715 13		7,079 33		7,151 14		6,442 43	
Provisions, clothing, etc., for negroes.	1,503 59		2,653 97		1,735 42		2,852 10		2,775 00	
		28,518 17		22,652 88		29,911 05		30,220 34		25,838 29
MAINTENANCE OF WAY.										
Men's wages,	12,514 12		12,103 67		12,549 58		18,322 73		14,862 76	
Supervisors,	1,999 94		1,[illegible] 36		1,733 29		2,724 23		1,694 77	
Provisions, clothing, etc., for negroes,	2,174 69		[illegible] 35		2,703 06		1,764 62		2,938 23	
Incidentals,	229 26		190 19		524 99		809 49		1,127 66	
Tools,	414 07		377 56		826 99		399 78		715 84	
Iron and spikes,					550 47		1,969 66		1,949 43	
Wooden rails and cross ties,	1,401 17		5,446 38		11,382 80		16,046 74		14,353 07	
Repairs of culverts,							376 88			
Work done by car factory,			436 20		511 16		795 70		184 95	
Work done by machine shop					910 17		1,474 51		366 26	
		18,733 25		21,836 61		38,692 51		44,684 34		38,156 97

MAINTENANCE OF CARS.										
Ordinary repairs,	4,936 30		4,735 20		3,660 00		2,144 37		6,045 45	
New baggage car,							1,050 00		1,050 00	
Renewal of wheels,					1,167 50		3,098 63		864 00	
Renewal of axles,							351 37		151 00	
New platform car,							2,500 00		1,565 00	
Extraordinary repairs.	480 00		189 15		1,287 00		600 00			
		5,416 30		4,924 35		6,114 50		9,744 37		9,675 45
		76,634 23		67,283 44		97,518 03		109,819 07		100,573 32

STATEMENT of the YEARLY RECEIPTS, EXPENSES and NET PROFITS of the GEORGIA RAILROAD COMPANY,

from the opening of the road to the 1st of April, 1844, exclusive of charges made for transporting materials used in building the road.

DATES.	Miles road in use.	PASSENGERS.		FREIGHT.				Mail, rents and storage, etc.	Total receipts.	Total expenses.	Net profits.
				Up.	Down.		Up and down.				
		Numb.	Amount.	Amount.	Amount.	Bales cotton.	Amount.	Amount.	Amount.	Amount.	Amount.
From Nov. 1, 1837, to May 1, 1838	40	12,986	23,164 00	4,390 00	8,199 00	8,267	12,589 00		35,753 00	19,367 00	16,386 00
" May 1, 1838, to May 1, 1839	75	28,091	66,140 00	27,543 00	33,429 00	25,613	60,982 00	7,807 00	134,929 00	63,362 00	71,567 00
" May 1, 1839, to April 1, 1840	88	22,632	63,505 00	35,245 00	66,174 00	47,235	101,419 00	19,679 00	184,603 00	70,246 00	114,357 00
" April 1, 1840, to April 1, 1841	105	22,910	66,262 00	37,463 00	28,963 00	20,878	66,426 00	25,537 00	158,225 00	67,283 00	90,942 00
" April 1, 1841, to April 1, 1842	147 1-2	22,784	71,460 00	59,610 00	59,358 00	40,611	118,968 00	33,827 00	224,255 00	97,518 00	126,737 00
" April 1, 1842, to April 1, 1843	147 1-2	19,075	61,935 00	69,591 00	84,574 00	63,276	154,165 00	31,926 00	248,026 00	109,819 00	138,207 00
" April 1, 1843, to April 1, 1844	147 1-2	19,003	65,667 00	69,661 00	78,400 00	70,754	148,061 00	34,367 00	248,096 00	100,573 00	147,523 00
		147,481	418,183 00	303,503 00	359,107 00	276,634	662,610 00	153,143 00	1,233,887 00	528,168 00	705,719 00

SUSPENSION AQUEDUCT.

We are glad to learn that an aqueduct suspended by wire cables is to be erected at Pittsburgh by Mr. John A. Roebling, C. E., a name familiar to the readers of the *Journal.* The span is 160 feet, the deflection 17 feet and the total weight of trunk, cables and water, 353 tons of 2000 lbs. The strain at the points of suspension is estimated at 451·21 tons, the area of each chain is to be 27 sq. in. and the wire of which they are formed is calculated to bear a maximum load of 90,000 lbs. per sq. in.; but the greatest strain to which the cables will be actually subjected will not exceed 18,000 lbs., or $\frac{1}{5}$ of the maximum load.

The trunk will be of wood, 13·5 ft. at bottom, 15 ft. at water-line, sides 8 ft. high, all of 3 in. plank, in two courses laid diagonally, and well spiked together. The stiffness of the trunk will be sufficient to prevent vibration, even in the most violent storms and will be sufficient to support itself when empty.

A wooden aqueduct is estimated at $850,000, and Mr. R. says in a communication published in a Pittsburg paper.

"I have estimated, and I am willing, to undertake a thorough repair of the piers and abutments for $7,000
"Adding to this the expense of the new structure, of 56,000
"And we have a sum of, 62,000
as the total expense of a suspension aqueduct, including everything."

He also very justly observes,

'There is another and a strong argument in favor of the suspension plan, which is entitled to attention. The true interest of the city, as has been observed before demands a permanent work. But the principal parts of a suspension auqeduct will be formed of iron and stone, which will last for centuries. And the wooden parts, the trunk and the beams can at any time be substituted by iron ones, so as to render the whole structure imperishable, and insure the services of the aqueduct for the future. The difference of weight by the substitution of iron for the beams and trunk in place of wood, would be in favor of iron.'

The idea of carrying the Croton water across the Harlem river suggested itself to numerous persons, and we are by no means certain that it would not have been quite as safe as the present structure, at one-fourth the cost. Mr. Roebling quotes the opinions of some eminent French engineers in favor of the application of the principle of suspension to aqueducts, and appears to have thoroughly investigated everything likely to have any bearing on the success of this new and—as we think—great improvement on the ordinary wooden aqueducts of this country.

NORTHERN RAILROADS.

The railway is creeping up to the Canada lines, and we understand that a survey of a route or routes thence to Montreal is going on at this time. The line from New Haven up the Connecticut river and that from Boston across the country will ere long meet, and the question then is, shall we cross Vermont to Burlington on lake Champlain, or continue the route north by lake Memphremagog to Montreal. The distance will of course be less to Burlington, and, as this line will traverse the best part of Vermont, its receipts will be much greater than the direct line to Montreal which runs for many miles through a wilderness. The travel from Montreal to Bos-

ton will be well accommodated by either route and as the line to Burlington will receive the trade of Vermont, of lake Champlain and of the iron region of New York *in addition*, it appears to us that, in the vital consideration of income, it has very decidedly the advantage over its northern rival. Both routes have been examined, though not instrumentally. The survey now going on will give all the requisite information as to the ground on the direct line to Montreal, and though we have no hope of ever seeing a railway there we still believe that the survey now making may not be without benefit. For, if skilfully conducted, it will show whether a railway can succeed there, and, if that be impracticable, what other communication can be recommended.

But the present break in the line from Montreal to Boston and New York —we mean the distance from Saratoga to Whitehall—which has been a cause of complaint to the travelling community for the last ten years and which is likely to remain so for some years longer, prevents us from indulging in any anticipations of a good route to the north. This link is alone required to complete the communication by steam from the St. Lawrence to the Hudson, that is, from Quebec almost to Charleston, yet it is scarcely spoken of.

ENGLISH RAILWAY BILL.

Our readers will perhaps recollect that some of the arguments used against the *probable* effect of the "Railway Bill," are precisely those used by some of our contributors as well as ourselves against the *actual* effect of our New York system of "State works," in crippling private enterprize and degrading the profession. The following is from Herapath's Railway Magazine, Feb. 6, 1844.

"Shortly and quietly thus stands the case between the two parties. The government sees in the large and growing capitals of the railways and the endless offices that arise out of them, a new and vast source, from which it could derive fresh, and an almost unlimited extension of patronage, and of course of power. Garnish it how parties please, this is the simple and naked fact. No man can deny it, no one can give any other reason for the present bill. What is the case with the other or companies' side. Briefly this; they have laid out a great deal of money, have had a great deal to contend with, have hitherto received but little return, and of course now when railways are beginning to show symptoms of repaying them for their trouble, loss and anxiety, they are very anxious to enjoy the fruits of their enterprize, and the management of their property. If left undisturbed, they find they can do both with advantage to themselves and the public. They say, and very truly, "if it had not been for us, these lines would not have been made, and why, therefore, when we have risked and done so much, are we to be dispossessed of them?" That the government would not have made them is certain, for when the companies were in difficulties, and many of them in danger of being obliged to abandon their works, it would not nelp them with the smallest donation or even loan. Is it just then, that it should enjoy that which it neither created or assisted? That it should wrench from enterprizing individuals, the work of their hands, the moment it bids fair to repay them for their labor and risk? Where do we find a

parallel to this? Men have hitherto been allowed to reap that which they have sown, and the success of their labors has always been considered exclusively and sacredly their own. Government has never interfered with mercantile speculations, but has been satisfied with that, which it must have one way or the other, from direct or indirect taxation of successful enterprize. Private enterprize has justly been regarded as the body and soul of the prosperity of the country, and for that reason has always been encouraged, and its results respected. The present is the first instance within the compass of our knowledge, of the executive thinking to intermeddle with it. A new light has, however, now broken in upon the ministry. It is considered advisable, that her majesty should become coach-mistress-general and carrier-in-chief of the country. All the engine drivers and stokers and guards and ticket takers and clerks and porters, are to hold their appointments direct from the royal hand, and the minister of the day to have the patronage of the appointments. To accomplish so desirable an object, good old customs are to be broken through, private rights are to be trampled on and the sanctity of property violated.

"The advocates of this measure may contend that the sole object is to interfere with the future lines only. We admit that is the professed and ostensible object, but like their profession of non-interference it is all a hollow sound. The real object is the possession of all the railways, and the present are to be reached through the future. No man doubts this now, it is too clear and transparent. We have long seen and long taught it, but were not believed. Our hints and warnings were looked upon as idle croakings and therefore disregarded, but now there is but one view, one sentiment, one opinion among all men. They all see and all acknowledge that the government object is to seize the railways, not for the sake of doing good, but for the sake of the patronage, and to have the key and control of all our movements. How far this is desirable, and the use that may be made of it, may be judged of from the late creditable transactions in the post office.

"Here is one point of view in which we wish the public to consider the consequences of the State getting possession of the railways. The public has lately seen how much the sanctity of the seal is respected and if the railways get into the hands of the government, it may soon find that the boasted liberty of locomotion will be just about as much valued. It is impossible to enumerate the uses to which the possession of the railways in the hands of a jealous or arbitrary government may be turned. In times of election they would be powerful instruments in obstructing this return or forwarding that, and consequently in controlling the elections and filling the house of commons with just such members as may be wanted. We recommend the public well to look to this side of the subject before it urges on an event it may have so much occasion hereafter to repent.

"Again, with regard to the fares, the public is tickled with the notion that if the government had the railways, travelling would be much cheaper. A greater mistake never was made. It is true all the government might care about would be the covering of the expenses, and the return of the low rate of interest at which, on the State security, the money may be raised. But then the government management of everything it takes in hand is so notoriously costly, that there would be at least double the persons to do the work of the present. Men who get into government situations do not expect to work, but simply to receive their salary. What said a well paid government official to a friend of ours sometime since, who was complementing him on the goodness of his post? "There is more trouble in it, sir, than you are aware of. Besides paying a deputy I am obliged to sign

my name four times a year to receipts for my salary." Thus it is with government officials, and thus it is the expenses of everything it takes in hand are increased. It is not too much to say, that if the present railways were in the hands of the government, that the expenses of working them would be doubled or tripled. The saving, therefore, in interest would be much more than swallowed up in the expenses, and the executive, supposing it had the most cordial desire to benefit the public by cheaper travelling would be unable to do it, or if it did the chance is that the public would have to make up deficiencies by other taxes. If ministers are wise they will have nothing to do with commercial matters, and if they are inclined to, the public will act wisely to check and prevent them.

"We have an example of the expense of State management in the Belgian railways. There, though the management is under the most economical arrangement, the expenses much exceed ours, which are yet far from reduced to their minimum. What, then, would the working expenses be under our notoriously costly executive? We repeat, if the State take railways into its keeping, the public will have cause to repent it, not only as furnishing the government with a new and dangerous instrument of control but as putting into its hands matters which it would be unable to manage economically, and which would therefore, in all probability, entail upon the country a loss in proportion to its magnitude.

"But the principle of the bill is not more unjust, than are its clauses monstrous and unheard of. If, after 15 years from passing the act of any railway, its profits should exceed 10 per cent., the board of trade may lower the tolls. And if it finds it has gone too far, and reduced the profits below 10 per cent., it may elect between raising them and paying the deficiency below 10 per cent. out of the public purse. To the latter part the railways could not object; it is for the public to consider how far it is palateable to itself to pay for the board of trade errors. But here also comes in another most iniquitous clause, namely, that the board of trade is to have the sole power of deciding whether the management of the railway is economical, and to make deductions accordingly from the expenses. So that the board of trade is first to curtail the profits, and then to be sole judges of the economy of management!"

A deputation consisting of the representatives of 29 railway companies, the united capitals of which exceed £50,000,000 presented the following:

"*Statement of a few prominent reasons against the measure.*"

"This bill is objected to,—

"1. Because its provisions are not called for by any complaint on the part of the public, expressed by petition or otherwise, with reference to the matters to which it relates.

"2. Because it is introduced at so late a period of the session, and so closely following the voluminous reports and evidence on which it is alleged to be founded, as to render it quite impossible that its provisions should have sufficient considerations either by the legislature or by the parties affected by it.

"3. Because the bill (taken in connection with the reports and the resolutions therein proposed to be adopted as standing orders) is obviously intended to vest in a department of the government a power of interference with, and undue control over, all existing as well as future railways, by enabling them to foster and encourage competition in all cases where existing companies will not submit to any terms and conditions, however stringent or ruinous, which may be sought to be imposed on them; and by enabling

them also, if they think fit, to become themselves the proprietors of all new and competing lines of railway.

"4. Because such a proposal is at variance with the principles which have hitherto governed the legislature of the country in its conduct, not only towards railways but towards all similar undertakings, and would have the effect of shaking the public confidence and security for the future in all such undertakings, and in all privileges granted by the legislature.

"5. Because the exclusive application of such a bill to railways only is obviously most unjust.

"6. Because an unheard-of power would be vested by the bill in the government, giving rise to a system of private solicitation and influence, and possibly to the exercise of undue partiality, in matters which have hitherto come openly and exclusively under the cognisance of the legislature.

"7. Because there is no experience in this country to justify so great a change in the system of legislation with reference to railways, as that proposed and the experience afforded by foreign countries only demonstrates the superiority of the system which has hitherto prevailed in England, where public works, promoted by private enterprize and unfettered by government interference, have flourished to an extent unknown elsewhere.

"8. Because there is no pretence for such government interference aris ing out of misconduct by railway companies, or undue profits realized by them; but, on the contrary, it is admitted on all hands, that the undertakings under their charge have been admirably managed, at liberal rates to the public, and, on the aggregate, with insufficiently remunerative profit to themselves.

"9. Because, if such undertakings were vested in the hands of the government, and should prove unsuccessful, the loss which is now borne by private companies, would have to be made up by general taxation; and it is most unfair that the government, as proposed by the bill, should have an option of purchasing only those undertakings which are profitable, and rejecting those which are unprofitable.

"10. Because the power to reduce the charges of companies paying a dividend of 10 per cent. under the guarantee of maintaining that dividend, would leave the company to whom such guarantee should be granted, without further inducement to meet the public convenience, and thus, while the guarantee in case of deficient revenue would have to be made good by the public, they would be worse served than at present.

"11. Because the provisions of the bill which give immediate power to the board of trade to regulate third class trains, are inconsistent with the existing rights of railway companies, and the provisions which declare that their stations shall be open to all public conveyances, are calculated to benefit only a small section of the community, viz., the hackney cab and omnibus proprietors, to the manifest inconvenience and annoyance of all the rest of the community, and would tend to the utmost confusion, extortion and general inconvenience.

"12. Because the attempt by the government to tamper and meddle with undertakings in which property has been embarked, on the security of privileges granted by the legislature, tends to weaken the faith and security of the capitalist in those undertakings, and to induce him to embark his property in foreign speculations, to the infinite detriment of this country: and if the present attempt should prove successful, it would afford a precedent for others, directed not only against railways but against all similar undertakings."

WELLAND CANAL.

It appears that two-fifths of all the wheat coming this year from the west pass through the Welland canal, but only one-fourth of this quantity goes to Canada. Wheat for Oswego and Ogdensburg finds a shorter route by the Welland than by the Erie, besides avoiding transhipment. Our correspondent on the "Canals of Canada" has uniformly considered this as a work of more importance to New York than to Canada and the trade this year will bear out that view. Some years since, in an article on the "Spring Trade," he went so far as to place the Welland canal at the head of all routes for early freight to the west, by way of Albany, *if* the New York railways could only carry freight; and, as they now have this privilege, though to a very limited extent and with exceedingly heavy pecuniary impositions, we shall soon see whether the merchants of Boston and New York will avail themselves of the new route for early freight, via Oswego and the Welland canal, the western terminus of which is to the westward of Dunkirk, besides being on the windward side of the lake, thus offering in *late* seasons an earlier route by canal than can be furnished by any railway in the State of New York. Such at least are the views of the correspondent alluded to.

The Welland canal will however become doubly important to New York, should a drawback be allowed by our government. Then will Upper Canada receive nearly all her supplies via New York and Oswego, and the people on the borders of lake Huron will receive their spring goods some weeks before the arrival of the first ship at Montreal. Indeed that city itself may be reached via Oswego and the St. Lawrence about two weeks before that period: and, it is very certain, that the entire Upper province will be tributary to New York as soon as a little common sense can be infused into congress. Fearful odds, it will be said, but we are not without hope. Now our correspondent who is well acquainted with the trade of the Erie canal and of the St. Lawrence says that *all* the *down* freight must go by the river to Montreal and if all or nearly all the *up* freight should go by way of Oswego, what are the canals on the St Lawrence to do?

Had our Canadian neighbors built the Great Western railway from Hamilton to Detroit they would have had a work which would have yielded a surplus the first year, and which would have made us tributary to them; but there is no accounting for tastes. The following extract does not state the tolls received in 1842 and 1843. We believe they have little if at all exceeded $100,000, the interest on two millions or half the estimated cost of the canal. It was not till the year 1839 that the Erie canal had paid expenses and interest, that is thirteen years after its opening. On the other hand the four railways from Schenectady to Rochester paid from the beginning, though not allowed to compete with the canal in the transportation of freight.

"*The Welland Canal and its Business.*—The Buffalo Commercial of Saturday gives this description of the Welland canal and of its business in the transportation of American produce.

"The work is 38 miles long 10 feet deep, and has a large number, some forty locks to overcome a rise of 360 feet existing between Port Dalhousie on lake Ontario, and Port Colborn, on lake Erie.

"The total business of the Welland canal for 1840 and 1841, was

		1840.	1841.
Flour,	Bbls.	186,864	193,137
Beef and pork,	"	14,889	24,195
Wheat,	bush.	1,720,660	1,212,460
Corn,	"	27,088	90,160
Staves,		1,623,000	2,725,000

"Among the items going towards the west, were—

Salt,	bbls.	153,030	149,337
Merchandize,	tons	2,770	3,718
Tolls received,		£18,037	£18,583

"The quantity of a few leading articles exported from the port of Cleveland alone, throguh that channel, was—

		1842.	1843.
Wheat,	bush.	380,684	90,689
Corn,	"	59,670	78,481
Flour,	bbls.	94,248	49,360
Pork and beef,	"	40,098	5,000
Total value of all exports,		$1,017,000	$357,400

"This season the shipments from Cleveland have been very heavy, and will doubtless exceed those of 1842.

"A partial and satisfactory view so far as it goes, may be had of the extent of the shipment by the Welland canal this season, obtained from the St. Catharines, W. C., Journal:

"The amount of wheat entering this season at Port Colburn up to the 22d July was 865,024 bushels, of which 657,429 bushels were for Oswego and Ogdensburgh, and the remainder as follows—

	St. Catharines.	Kingston.	Grananoque.	Total.
Wheat bushels,	09,329	57,507	50,799	207,655

the duty on which at 9 cts. a bushel, amounts to £4,672, which, added to the sum collected on flour, pork, and other products, cannot fail to give an increase of revenue far beyond any former period. This exhibit must be of considerable interest to the trade, and we shall look with much anxiety for further movements."

Since the above was in type, we have seen in the papers an article from the St. Catharine's Journal in which the editor says:—

"*Welland Canal.*—In our last number we gave a brief statement of the unprecedented and rapid increase of the trade of lake Erie, and the small proportion of it as yet secured for Canada, by the St. Lawrence. But we have no doubt that the efforts now making—by the improvement of our water communications—to divert this commerce into its natural channel, will, ere long, be crowned with success."

Did not our modesty interfere we would recommend our Canadian neighbors to take the Railroad Journal, when they would no longer talk such nonsense. The "natural channel" is that which takes the wheat where it is wanted and the wheat passing via the Erie canal is for consumption in this country. There are of course a few hundred thousand barrels shipped

to South America, England and the West Indies, but not enough sensibly to affect the income of the Erie canal. Now how is the million of barrels shipped to Boston to reach that port via the St. Lawrence? It has already been explained over and over again, that the trade via the St. Lawrence is in *addition* to that of the Erie canal, and the insignificant amount of produce taking the former route shows the smallness of the demand in Montreal and is in no degree influenced by the cost of transportation from lake Ontario to Montreal—30 to 35 cts. per barrel—an amount insufficient to affect the demand to any extent. Were flour carried now for 15 cts. per barrel from Kingston to Montreal it would not add one hundred thousand barrels to the trade of the St. Lawrence. But twelve years unremitting attention to these matters has taught us the almost impossibility of projecting works to be executed at the expense of the public with any degree of intelligence and skill, or conducting them with the economy, order and method so necessary to insure success. *As long as the money holds out* the political adventurers will cry out for more and backed by their political engineers *will succeed* as they have in New York, in saddling the people with an enormous debt and a lot of preposterous works, such as the Chenango, Black river, Genesse valley canals and the enlargement of the Erie, on which 20 millions have been spent and which will require 20 millions more to complete them, the interest to be paid by taxation.

BEAUHARNOIS CANAL.

Some astounding developements have taken place with reference to this portion of the St. Lawrence canal. Those of our readers who see the "Civil Engineer," the organ of the profession in England, may recollect an article from the pen of Mr. Casey, on the "Canadian Board of Works," (Feb. 1843,) in which he places their integrity on a par with their capacity. We now see it openly announced in London that a notorious personage of the name of *Wakefield*, who figured some 16 years since in a most infamous abduction case, was paid $60,000 for securing the construction of the canal on the south bank of the St. Lawrence, through the property of a company at one of whose meetings the above statement was made by the directors! Log-rolling is nothing to this. We console onrselves to some small extent with the idea that the profession is not responsible for this barefaced bribery. That is, we hope that the Engineer, Mr. Hamilton H. Killaly, through whom this was effected, will turn out to be no engineer at all. Indeed we do not see how it is possible that he should be, when neither the Editor nor the readers of the "Civil Engineer" have answered Mr. Casey's inquiry of September last as to the standing of Mr. K. in his own country. Within a few days we have seen one of his most important papers and such a document never emanated from any *other* engineer—if he be one—as all will admit who see this extraordinary production. Taken in connection with the $60,000, the "modus operandi" of placing the canal on the south or Beauharnois side is traced with a pencil of light.

But we will always show fair play, and if any of our readers can refer us to any canal or railway in England or Ireland, however small, constructed under the direction of Mr. H. H. Killaly, we will cheerfully insert an account of it in our columns and thus answer in part Mr. Casey's advertisement of Mr. K. (for such it is) in the "Civil Engineer," the readers of which Journal are obviously at fault, though they of course comprise the entire profession in England and Ireland, and though Mr. Killaly speaks of his "long professional career." They certainly *ought* to be known to each other. We may perhaps introduce Mr. K. to the profession in the United States in another number by means of some extracts which, our readers will be forced to admit are somewhat different from anything they have ever seen.

PRINCE DE JOINVILLE'S PAMPHLET.

The Prince's pamphlet on the importance of a steam navy to France is published at length (translated) in the Civil Engineer's Journal for July. The editor very truly says that the Prince is a person of much common sense when he pleases and—when not speaking for "Buncombe" which is pretty nearly the American for "young France"—the tone, style and manner of investigation are those of a truly practical man, well versed in his profession and who has given much attention to the higher departments of the service. It is of interest to us as showing the important part which the civil engineer is to play in another war, and, still more so from the great stress which the Prince lays on the importance, indeed the necessity of encouraging private enterprize and not trusting to government establishments the difficult and complicated machinery of men-of-war steamers. We make a few extracts.

"One fact of immense import, which has been accomplished of late years, has given us the means of raising our fallen naval power, and of making it re-appear under a new form, admirably adapted to our resources and national genius.

"This fact is the institution and progress of steam navigation.

"Our navy could only be an artificial creation when the empire of the sea belonged to the one who put afloat the most seamen. Our ruined mercantile navy no longer furnished us seamen enough; we should have vainly struggled to avenge affronts, to efface melancholy remembrances; but when even temporary success had attested the courage of our seamen, numbers would in the end have stifled our exertions. The steam navy has changed the face of everything; now it is our military resources which are about to take the place of our impoverished naval personnel. We shall always have enough officers and seamen to perform the part still open to a seaman on board a steamer. Machinery will supply the place of hundreds of arms, and I need not say that we shall never want money to construct engines, still less that we shall never want soldiers when the honor of the country is to be maintained.

"With a steam navy, the most audacious war of aggression is permitted by sea. We are sure of our movements, unshackled in our actions. Time, weather, tide, no longer disturb us. We can calculate to the day and hour."

"In all, England now reckons one hundred and twenty-five steamers.

Of this number, seventy-seven are armed, and to these must be added two hundred steamboats of superior quality, fit for carrying heavy guns and troops, which the merchant navy could furnish to the State on the very day they were wanted.

That is not all: to form an idea of the real force of this steam fleet, we must have seen close at hand how formidable its equipment is, we must have seen the care and skilful foresight with which everything has been designed. The English war-steamers have not been designed warranted good for every kind of service without distinction, in their construction only one idea, one end has been in view—war. They conjoin with a marvelous fitness for sea purposes, high speed, powerful artillery and plenty of stowage for passenger troops."

"What they particularly wanted was to be employed on stations where they could be put in comparison with foreign vessels. This inconvenience together with the prejudices exclusively prevailing in favor of the sailing navy, was the reason why the progress of our steam fleet from 1830 to 1840 was so nil. Science however had progressed. The royal navy of England having leisure for experiments, and further, having under its eyes a merchant steam navy in which number and competition produced daily progress, turned out some magnificent vessels."

"By an excess of foresight too common with us, the administration has thought fit first of all to create repairing establishments for the new navy. In all our ports now rise magnificent factories enclosed in stately monuments. These factories are for the purpose of repairing the damage, and providing for the wants of the steam navy, and this navy is only in its infancy.

"However as these large factories cannot be left without employment nor the workmen without work; as besides in the nature of things, all the steamers we have are employed at Toulon, and that there are only steamers to repairs at that place, what has been done with the factories constructed in the ports of the ocean? They have been employed in manufacturing engines, instead of giving the contracts for them, as a premium to private industry.

"We had already Indret and its costly productions. Was it necessary to add to this luxury of establishments? Was it requisite to employ the money destined for the increase and improvement of the fleet, in raising monuments of which the immediate utility is far from being demonstrated?

"We have always been inclined to increase without limit the immovables of the navy, to the detriment of everything efficacious and active in the department. It would be good to try the other plan, and I am convinced that we should readily find the means of arming a true steam fleet and encouraging a useful trade, by requiring from private establishments, fine and good machines, such as they know how to produce.

"If I were here to trace the true state of our steam navy, if I were to say that of this number of forty-three steamers afloat borne on the budget, there are not six fit to compare with the English vessels, I should not be believed, and I should still have asserted the strict truth. The greater number of our vessels belong to that class good in 1830, when they were turned out, but now, most certainly much behind present improvement. These vessels subjected in the Mediterranean to a navigation without repose, have almost all reached a premature old age. As I pointed out just now they are no longer sufficient for the service of Algiers and the political missions on which they are sent, for want of better vessels. The officers who command them blush at seeing themselves weak and powerless, I will not say

alongside the English only, but the Russians, the Americans, the Dutch, the Neapolitans, who have better steamers than ours."

"Perhaps the use of the screw, by leaving the steamer all the power of a sailing vessel, will some day produce a change in the state of things. Steam will then become a powerful auxiliary to our cruisers, but this alliance of sail and steam would change nothing as to what I have before laid down. The steamer destined to serve in squadron or on our coasts, should always have a high speed, by steam alone, as the first means of success."

Omitting the appeals to the worst passions of the French, their "love of glory" as they call it, but their insatiable desire for plunder as it is only too well known to be by most nations and certainly by the American commercial marine, omitting this which the Prince has probably introduced as a matter of necessity rather than of taste, we think his views compare very favorably—indeed they completely overturn the position of the spirited but unfortunate Captain Stockton, who had the egregious vanity to imagine and even to announce, just before the terrible disaster at Washington, that the discoveries and improvements introduced in the Princeton would change the entire system of naval warfare and would put the weakest nation on the ocean on a level with the most powerful! The Prince shows, though he does not admit it, that steam has actually increased the relative power of England, and it is easy for us to gather from his statements that, in six months, the United States would be more than a match for France, as regards *steamers*, owing to the skill and immense capabilities of our private engineering establishments.

HERAPATH'S RAILWAY MAGAZINE.

We are indebted to some kind and attentive friend—for such we must consider him—for copies of this spirited periodical, immediately on the arrival of the steamer. We have in this number an article on "Railway Legislation" and can give no stronger proof of the accuracy of the editor's views than, that all and more than all the evils he anticipates from the interference of the government *there*, are matters of fact *here* where the States have taken works into their own hands. In our next we may recur to this subject, to which we devoted much attention some time since. Indeed a long article was copied from the *Journal* into the III volume of the "Civil Engineer," in which the unhappy effects of government engineering were pointed out and where the editor of Herapath's Railway Magazine will find some of his worst suspicions borne out by our experience. There is little probability that any new works will be undertaken by the States, and at this moment Canada stands alone as the advocate of the "system" which, in the case of the Beauharnois canal, they have certainly carried out with great additions if not improvements. On the other hand, private enterprize here is recovering from the effects of its long struggle with the State governments and railways are rapidly extending themselves in all directions. Indeed all we ask is to be "let alone," and the country will soon have railways and canals of the first order wherever they are required, and that too

without either the taxation of New York and Canada or the repudiation of Pennsylvania and Michigan.

OPENING OF THE LONG ISLAND RAILROAD TO GREENPORT.

On Saturday, Aug. 3d, the officers and directors of this company with a very large number of invited guests, among whom were the corporations of New York and Brooklyn, most of the notabilities of Long Island, Jas. De Peyster Ogden, prsident of the chamber of commerce, the officers and directors of the New Jersey railroads, and very many other citizens, amounting probably altogether to some five hundred persons, made an excursion to Greenport and back to this city.

The party left Brooklyn at 8 o'clock in three trains of cars; the leading train making only two stops, arrived at Greenport in 3 hours and 35 minutes; 6 minutes were occupied in taking on wood and water, thus reducing the the time occupied in running over the distance of 95 miles to 3 hours and 29 minutes- The engineer expressed an opinion that with the new locomotive now building by the company he will be able to run over the road in less than 3 hours.

Time occupied in running from Brooklyn to Jamaica 23 minutes, distance 11 miler.

	Hours.	Minutes.	Miles dis.
Hicksville,		56	26
Farmingdale,	1	6	31
Stopped for wood and water,		3	
To Deer Park,	1	21	37
Thompson station,	1	31	43
Suffolk station,	1	35	46
Medford station,	2	1	55
Carman's river,	2	13	61
St George's Manor,	2	27	66
Stopped for wood and water,		3	
Riverhead,	2	48	74
Greenport,	3	35	95

We should be pleased to give an account of the grades, curves, stations, engines, cars and cost of the road, such as is given of the Central road in this number. The trains now run daily to Greenport and the distance to Boston by this route is accomplished in about 10 hours. The company are constructing a tunnel in Brooklyn in order to dispense with the use of horses. They go now thirty miles an hour with sixteen ton engines. A pretty severe trial to any track and a speed they will find it difficult to keep up.

The number of passengers taking this route is very great and we only hope our anxiety for its success has made us overrate the difficulties to be overcome in order to maintain an average speed of 30 miles per hour.

RAILWAY SPEED.

In our last week's impression, we gave a circumstantial account of the opening of tha Darlington and Newcastle railway, which completes the line of communication between the latter town and London. The special train which conveyed a party of directors and friends from London to Newcastle on that occasion, accomplished the journey, 303 miles, in the short space of nine hours and thirty-two minutes, being an average of about thirty-two miles an hour, including stoppages; but as this naked statement

would supply a very inadequate idea of the actual rates of progress on some parts of the line, we now give a tabular view of the performance. The train left the Euston square station at 3 minutes past 5 in the morning and reached Newcastle at 35 minutes past 2 in the afternoon. The following are the distances on the respective portions of the line, the time consumed in passing over each, and the rate per hour run:—

	Miles.	Hours.	Minutees.	Rate pr. hr.
London to Rugby (Birmingham line,)	83	2	11	38 miles.
Derby, (Midland Counties,)	49	1	22	36 "
Northampton, (North Midland,)	63	1	28	42 "
York, (York and North Midland,)	24	0	37	29 "
Darlington, (Great North of England,)	45	1	13	37 "
Newcastle,	39	1	20	20 "
	303	8	11	

Average 37 miles an hour.

The remaining time, 1 hour and 21 minutes, was consumed in stoppages. Of course, it would not have been prudent to run over the newly opened portions of the line at much more than the ordinary speed; but the rate of progress upon the older portions, considering the distance, is really astonishing, that on the North Midland especially; and we believe the performance altogether is quite unprecedented.—*Leeds (Eng.) Mercury.*

BEAUHARNOIS CANAL, AGAIN.

Little did we think when penning our brief article on this canal that we should so soon find such remarks as the following in a Canadian paper.

"It was our intention to have occupied our leisure during these dull times with an exposure of that most horrible and scandalous of all jobs, the Beauharnois canal, having acquired information to an extent never dreamt of by the guilty parties concerned in the nefarious business, but the truth is, we *dare not.* The *various participators* in the lare bribe of £12,500, occupy *too high a station in office and society to be safely exposed,* even when a journalist is doing a public duty and has truth on his side. Nothing but a committee of the Legislative assembly can bring this iniquity to light."—*British Whig, Kingston, Aug.* 9, 1844.

NORWICH AND WORCESTER RAILROAD.

For July, the increase of income on this route has been $9326, or about 75 per cent. over July 1843; and in the first seven months of this year, the gain has been $40,000, or 25½ per cent. This greatly exceeds the ratio of gain on the Western, and if continued through the coming five months, will, by December 31st, amount to $85,000, and added to the surplus of last year over interest and expenses (which was $25,000) will give a net revenue of $110,000, or nearly seven per cent. on the capital stock, and will leave a reasonable reserve fund besides.—*Bost. Trans.*

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